

Please add new claims <sup>17</sup>21 and <sup>18</sup>22 as follow:

<sup>17</sup>~~21~~. A catalyst for addition polymerization of olefinically unsaturated monomers comprising:

(a) a first component of formula  $(ML_m)^{n+}A^{n-}$  wherein

M = a transition metal of low valency state;

L = an organodiimine where at least one of the nitrogens of the diimine is not part of an aromatic ring;

A = an anion;

n = an integer from 1 to 3;

m = an integer from 1 to 2; and

(b) an initiator compound comprising a homolytically cleavable bond with a halogen atom.--

<sup>18</sup>~~22~~. A catalyst according to claim <sup>17</sup>21, wherein A is selected from the group consisting of Cl, Br, F, I, NO<sub>3</sub>, SO<sub>4</sub> and CuX<sub>2</sub>, wherein X is a halogen.--

#### REMARKS

Claims 1, 3-8, 10-16 and 19-22 are pending herein. The Office Action objects to the specification, the drawings, and claims 1-16 and 19-20; rejects claims 1, 3-11, 13-16 and 19-20 under 35 U.S.C. § 112; rejects claims 13-16 and 19-20 under 35 U.S.C. § 101 and rejects claims 1-4, 6-11 and 19-20 under 35 U.S.C. § 102. This Amendment amends the title, the specification and claims 1, 3-4, 6-8, 10-16 and 19-20; cancels claims 2 and 9; and adds new claims 21 and 22. No new matter is added.

Applicants thank the Examiner for the acknowledgment that claims 5 and 12 are allowable except for being dependent on a rejected base claim. However, in view of the foregoing amendments and the following remarks, Applicants respectfully submit that all claims pending herein are allowable.

An Information Disclosure Statement with Form PTO-1449 was filed on July 22, 1999. Applicants have not yet received back from the Examiner a copy of one of the Forms PTO-1449 initialed to acknowledge the fact that the Examiner has considered the cited information. The Examiner is requested to initial and return to the undersigned a copy of the subject Form PTO-1449. For the convenience of the Examiner, a copy of that form is attached.

I. Objection to Specification

The Office Action objects to the specification and requests that Applicants submit a substitute specification. Applicants respectfully acknowledge the request, and submit that an appropriate substitute specification is being prepared and will be submitted when available.

In addition, the Office Action makes specific objections to the specification as containing various informalities. This Amendment amends the specification to overcome these objections. With respect to the Office Action's specific rejections to the specification, the specification satisfies the requirements of U.S. Patent practice. Reconsideration and withdrawal of these objections are respectfully requested.

II. Objection to Claims

The Office Action objects to the claims as including various informalities. Claims 1, 3-4, 6-8, 10-16 and 19-20 are amended, claims 2 and 9 are canceled, and claims 21 and 22 are added to overcome this objection. Claims 1, 3-8, 10-16 and 19-22 satisfy the requirement of U.S. Patent practice. Reconsideration and withdrawal of the rejection are respectfully requested.

III. Rejection Under 35 U.S.C. § 112, Second Paragraph

The Office Action rejects claims 1, 3-11, 13-16 and 19-20 under 35 U.S.C. § 112, second paragraph, as being indefinite. This Amendment amends claims 1, 3-4, 6-8, 10-16 and 19-20, cancels claims 2 and 9 and adds claims 21 and 22 to overcome this rejection.

Claims 1, 3-8, 10-16 and 19-22 satisfy the requirements of 35 U.S.C. § 112, second paragraph. Reconsideration and withdrawal of the rejection are respectfully requested.

The Office Action rejects claims 1, 3 and 5 under 35 U.S.C. § 112, second paragraph, as being indefinite for using the term "an organodiimine," Applicants respectfully submit that the term "organodiimine" is not indefinite. In particular, the prefix "organo" is known by those of ordinary skill in the art to refer to compounds of elements containing organic groups, wherein the element is bound to carbon atoms. See MINIDictionary of Chemistry, Oxford University Press, page 243 (1985), attached hereto. In addition, Applicants respectfully submit that the term "imine" is well known by those of ordinary skill in the art to refer to a compound that contains the group -NH- joined by two other groups. Moreover, the prefix "di" is well known by those of ordinary skill to indicate the presence of two groups in a compound.

Furthermore, exemplary organodiimines according to the present invention are specifically described in the specification. See for example page 4, lines 8-9, and page 9, line 21 to page 15, line 13. Other suitable compounds will be readily apparent to one of ordinary skill in the art.

Thus, Applicants respectfully submit that claims 1, 3 and 5 satisfy the requirements of 35 U.S.C. § 112, second paragraph. Reconsideration and withdrawal of the rejection are respectfully requested.

IV. Rejection Under 35 U.S.C. § 101

The Office Action rejects claims 13-16 and 19-20 under 35 U.S.C. § 101 as being improper "use" claims. This Amendment amends claims 13-16 and 19-20 to overcome this rejection. Claims 13-16 and 19-20 satisfy the requirements of 35 U.S.C. § 101. Reconsideration and withdrawal of the rejection are respectfully requested.

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V. Rejections Under 35 U.S.C. § 102(b)

The Office Action rejects claims 1-4, 6-11, 13-16 and 19-20 under 35 U.S.C. § 102(b) as being anticipated by Haddleton et al. ("Identifying the Nature of the Active Species in the Polymerization of Methacrylates," Macromolecules, vol. 30, pg. 3992-3995 (1997)). The Office Action alleges that the catalysts and processes disclosed by Haddleton anticipate the claimed invention. Applicants respectfully traverse this rejection.

Applicants respectfully submit that the rejection is improper because Haddleton is not a proper prior art reference with respect to the claimed invention. More specifically, Applicants submit that the Haddleton reference was published after the international filing date of June 12, 1997, and the priority date of June 12, 1996, of the present application. In particular, the enclosed Abstract of Haddleton, taken from the American Chemical Society website, indicates that the Abstract was not published until July 1, 1997. Moreover, Haddleton was not published in its entirety until July 14, 1997. Therefore, because the international filing date of June 12, 1997, and the priority date of June 12, 1996, both precede the earliest publication date of July 1, 1997, of the Haddleton Abstract, and because the instant application properly claims and is entitled to priority to both of the earlier dates, Applicants respectfully submit that Haddleton does not constitute a proper prior art reference with respect to the present application. Therefore, Applicants respectfully submit that any rejection based on Haddleton is improper, and should be withdrawn.

For at least these reasons, the claimed invention is not anticipated by Haddleton. Reconsideration and withdrawal of the rejection are respectfully requested.

VII. Conclusion

In view of the foregoing amendments and remarks, it is respectfully submitted that the instant application is in condition for allowance. Favorable consideration and prompt allowance of the application are respectfully solicited.

Should the Examiner believe that anything further is necessary in order to place the application in condition for allowance, the Examiner is invited to contact Applicants' undersigned attorney at the telephone number listed below.

Respectfully submitted,



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JAO:MAB/slm

Enclosures:

MINIDictionary OF CHEMISTRY, Oxford University Press, page 243 (1985)  
Abstract of "Macromolecules, 30(14), 3992-3995 (1997)

Date: August 24, 2000

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Identifying the Nature of the Active Species in the Polymerization of Methacrylates: Inhibition of Methyl Methacrylate Homopolymerizations and Reactivity Ratios for Copolymerization of Methyl Methacrylate/n-Butyl Methacrylate in Classical Anionic, Alkylolithium/Trialkylaluminum-Initiated, Group Transfer Polymerization, Atom Transfer Radical Polymerization, Catalytic Chain Transfer, and Classical Free Radical Polymerization

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Abstract:

Reactivity ratios have been determined for the monomer pair methyl methacrylate and n-butyl methacrylate under a range of polymerization conditions. The value of using reactivity ratios as a mechanistic probe is discussed. Reactivity ratios determined where M1 = MMA and M2 = n-BMA are 1.04, 0.81, classical anionic; 1.10, 0.72, alkylolithium/trialkylaluminum initiated; 1.76, 0.67, group transfer polymerization; 0.98, 1.26, atom transfer radical polymerization; 0.75, 0.98, catalytic chain transfer; and 0.93, 1.22, classical free radical polymerization. The data suggest ATRP and CCTP proceed via radical type propagation. Li/Al-initiated polymerization undergoes an anionic mechanism, while strong evidence is found for an associative, catalyst dependent mechanism for GTP. Galvinoxyl is demonstrated to inhibit GTP as well as free radical polymerization, and it is suggested that neither the use of inhibition nor polymer stereochemistry can be used to distinguish between anionic and radical processes.

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## orbital quantum number

ing two atoms) and there are corresponding molecular orbitals for electrons. It is convenient in considering these to regard them as formed by overlap of atomic orbitals. In a hydrogen molecule the  $s$ -orbitals on the two atoms overlap and form a molecular orbital between the two nuclei. This is an example of a *sigma orbital*. In a double bond, as in ethene, one bond is produced by overlap along the line of axes to form a *sigma orbital*. The other is produced by sideways overlap of the lobes of the  $p$ -orbitals (see illustration). The resulting molecular orbital has two parts, one on each side of the *sigma orbital* - this is a *pi orbital*. In fact, the combination of two atomic orbitals produces two molecular orbitals with different energies. The one of lower energy is the *bonding orbital*, holding the atoms together; the other is the *antibonding orbital*, which would tend to push the atoms apart. In the case of valence electrons, only the lower (bonding) orbital is filled.

In considering the formation of molecular orbitals it is often useful to think in terms of *hybrid atomic orbitals*. For instance, carbon has in its outer shell one  $s$ -orbital and three  $p$ -orbitals. In forming methane (or other tetrahedral molecules) these can be regarded as combining to give four equivalent  $sp^3$  hybrid orbitals, each with a lobe directed to a corner of a tetrahedron. It is these that overlap with the  $s$ -orbitals on the hydrogen atoms. In ethene, two  $p$ -orbitals combine with the  $s$ -orbital to give three  $sp^2$  hybrids with lobes in a plane pointing to the

corners of an equilateral triangle. These form the *sigma orbitals* in the C-H and C-C bonds. The remaining  $p$ -orbitals (one on each carbon) form the *pi orbital*. In ethyne,  $sp$  hybridization occurs to give two hybrid orbitals on each atom with lobes pointing along the axis. The two remaining  $p$ -orbitals on each carbon form two *pi orbitals*. Hybrid atomic orbitals can also involve  $d$ -orbitals. For instance, square-planar complexes use  $sp^2d$  hybrids; octahedral complexes use  $sp^3d^2$ .

**orbital quantum number** See *atomic order*. In the expression for the rate of a chemical reaction, the sum of the powers of the concentrations is the overall order of the reaction. For instance, in a reaction



the rate equation may have the form

$$R = k[A]^m[B]^n$$

This reaction would be described as *first order* in A and *second order* in B. The overall order is three. The order of a reaction depends on the mechanism and it is possible for the rate to be independent of concentration (*zero order*) or for the order to be a fraction. See also *molecularity*; *pseudo order*.

**ore** A naturally occurring mineral from which a metal can be extracted, usually on a commercial basis. The metal may be present in the ore as the native metal, but more commonly it occurs as a combined form as an oxide, sulphide, sulphate, silicate, etc. See *beneficiation*.

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**organic chemistry** The branch of chemistry concerned with compounds of carbon.

**organo-** Prefix used before the name of an element to indicate compounds of the elements containing organic groups (with the element bound to carbon atoms). For example, lead(IV) tetraethyl is an organolead compound.

**organometallic compound** A compound in which a metal atom or ion is bound to an organic group. Organometallic compounds may have single metal-carbon bonds, as in the aluminium alkyls (e.g.  $Al(CH_3)_3$ ). In some cases, the bonding is to the  $\pi$  electrons of a double bond, as in complexes formed between platinum and ethene, or to the  $\pi$  electrons of a ring, as in ferrocene.

**ornithine (orn)** An "amino acid",  $H_2N(CH_2)_3CH(NH_2)COOH$ , that is not a constituent of proteins but is important in living organisms as an intermediate in the reactions of the urea cycle and in arginine synthesis.

**ornithine cycle** See *urea cycle*.

**orpiment** A natural yellow mineral form of arsenic(III) sulphide,  $As_2S_3$ . The name is also used for the synthetic compound, which is used as a pigment.

**ortho-** 1. Prefix indicating that a benzene compound has two substituted groups in the 1,2 positions (i.e. on adjacent carbon atoms). For instance, orthodichlorobenzene is 1,2-dichlorobenzene. 2. Prefix formerly used to indicate the most hydrated form of an acid. For example, phosphoric(V) acid,  $H_3PO_4$ , was called orthophosphoric acid to distinguish it from the lower

metaphosphoric acid,  $HPO_3$  (which is actually  $(HPO_3)_n$ ). orthoboric acid See *boric acid*. orthoclase See *feldspar*. orthohydrogen See *hydrogen*. orthophosphoric acid See *phosphoric(V) acid*.

orthoplumbate See *plumbate*.

orthorhombic See *crystal system*.

orthosilicate See *silicate*.

orthostannate See *stannate*.

**osmium** A hard white naturally occurring alloy consisting principally of osmium (17.4%) and iridium (49%). It also contains small quantities of platinum, rhodium, and ruthenium. It is used for making small items subject to wear, e.g. electrical contacts or the tips of pen nibs.

**osmium Symbol Os.** A hard blue-white metallic transition element; a.n. 76; r.a.m. 190.2; r.d. 22.57; m.p. 3043°C; b.p. 5027°C. It is found associated with platinum and is used in certain alloys with platinum and iridium (see *osmiridium*). Osmium forms a number of complexes in a range of oxidation states.

**osmium(IV) oxide (osmium tetroxide)** A yellow solid,  $OsO_4$ , made by heating osmium in air. It is used as an oxidizing agent in organic chemistry, as a catalyst, and as a fixative in electron microscopy.

**osmometer** See *osmotic*.

**osmotic** The passage of a solvent through a *semipermeable membrane* separating two solutions of different concentrations. A semipermeable membrane is one through which the molecules of a solvent can pass but the molecules of most solutes cannot. There is a thermodynamic ten-

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